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GEOTECHNICAL ENGINEER



SEAL  
030943  
T. T. ZAN

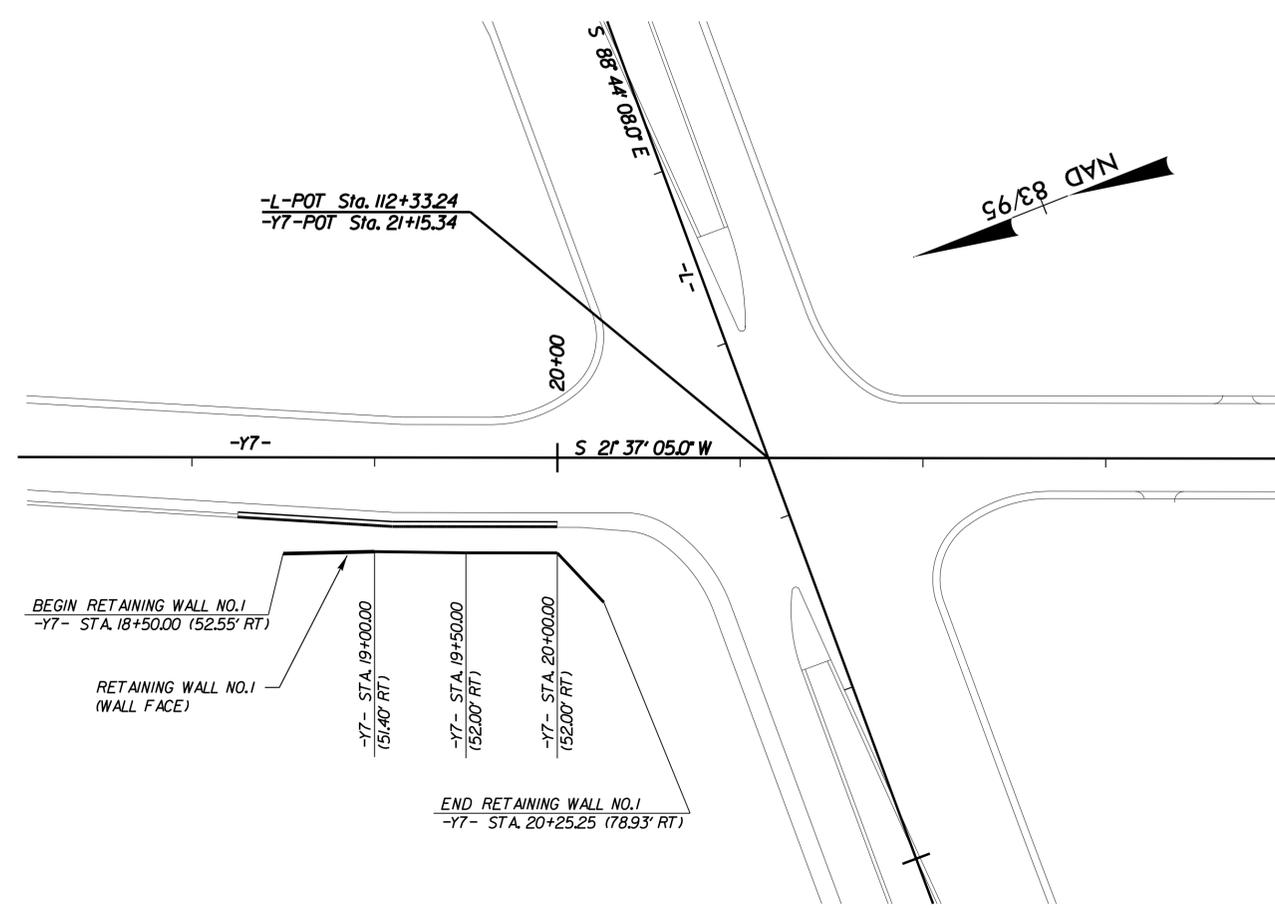
ENGINEER

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DocuSigned by:  
*T. T. Zan* 1/16/2018

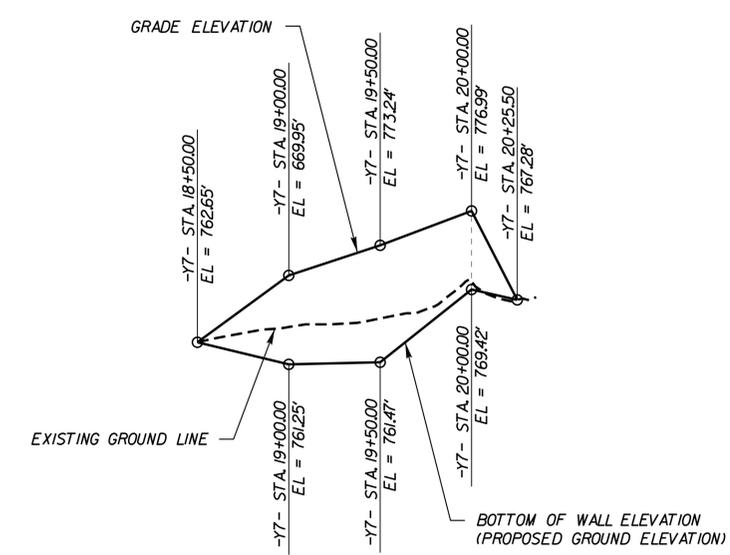
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**DOCUMENT NOT CONSIDERED FINAL  
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RETAINING WALL NO. 1 PLAN VIEW

NOT TO SCALE



RETAINING WALL NO. 1 WALL ENVELOPE

NOT TO SCALE

ESTIMATED MSE WALL QUANTITY (SQUARE FEET)	
MSE RETAINING WALL NO. 1	1,325 SF

PROJECT NO.: U-2412A  
 GUILFORD COUNTY  
 STATION: 18+50 -Y17-  
 SHEET 1 OF 4



**NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
ENGINEERING UNIT**

MSE RETAINING WALL NO. 1 PLAN & WALL ENVELOPE					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO.  
W-1

PREPARED BY: T. T. ZAN	DATE: 1/2018
REVIEWED BY: J. BATTS	DATE: 1/2018

GEOTECHNICAL ENGINEER

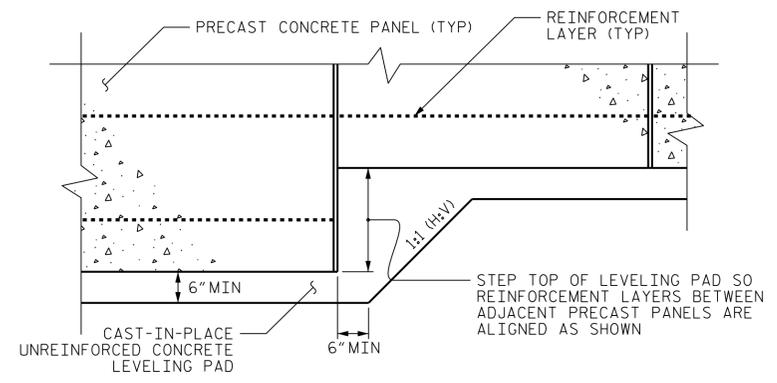
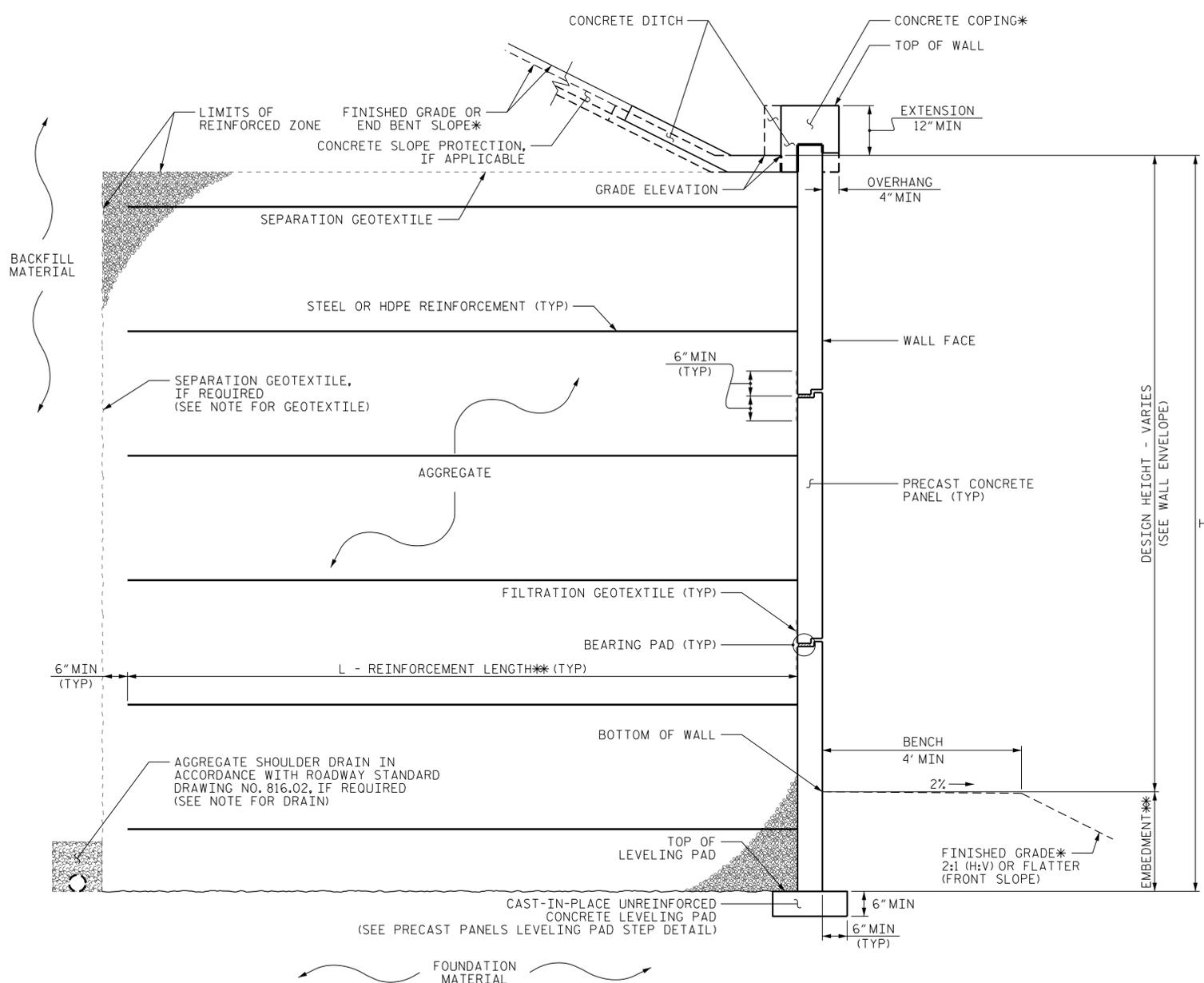
ENGINEER

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*Thiin Tun Zan* 1/16/2018

DATE SIGNATURE DATE

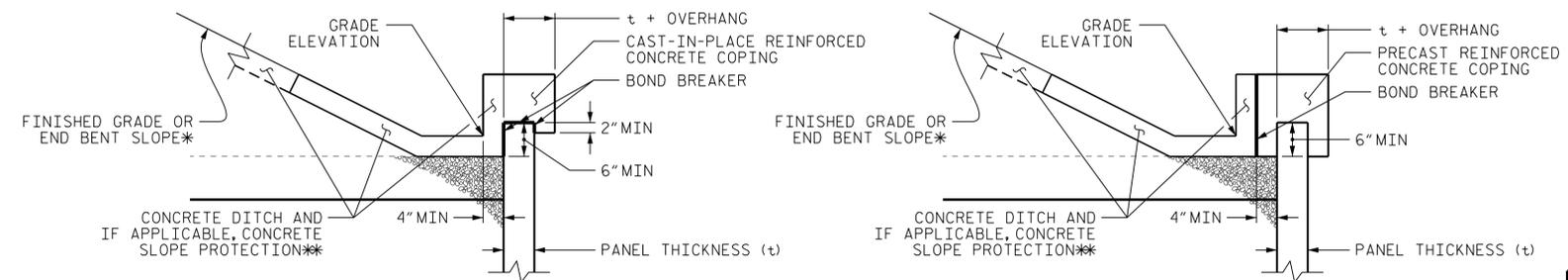
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**PRECAST PANELS  
LEVELING PAD STEP DETAIL**

**MSE WALL WITH PRECAST PANELS - TYPICAL SECTION**

\*SEE COPING DETAILS AND PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.  
 \*\*SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE, MSE WALL NOTES FOR EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.



**COPING DETAILS**

\*SEE PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.  
 \*\*SEE CONCRETE DITCH BEHIND WALL DETAILS.

PROJECT NO.: U-2412A  
 GUILFORD COUNTY  
 STATION: 18+50 -Y17-  
 SHEET 2 OF 4

**NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
ENGINEERING UNIT**

REVISIONS						SHEET NO. W-2
NO.	BY	DATE	NO.	BY	DATE	
1	-	-	3	-	-	
2	-	-	4	-	-	

PREPARED BY: T. T. ZAN      DATE: 1/2018  
 REVIEWED BY: J. BATTS      DATE: 1/2018

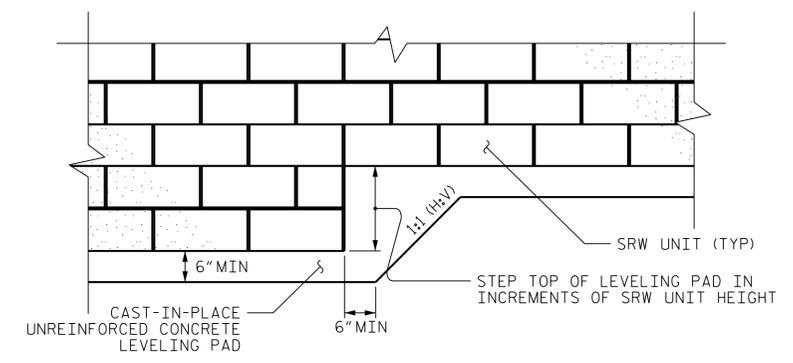
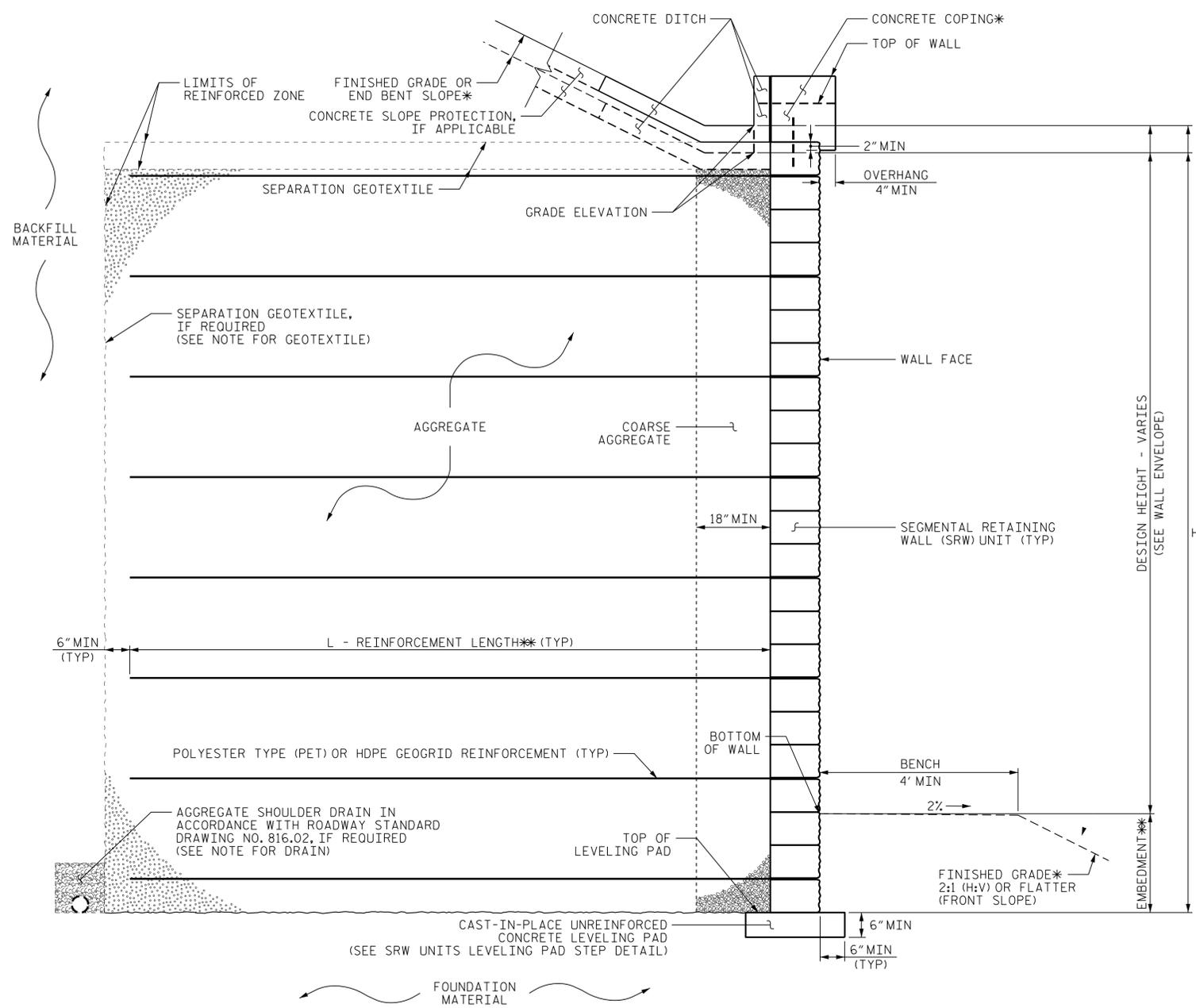
GEOTECHNICAL ENGINEER

ENGINEER

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Thien Tun Zan 1/16/2018

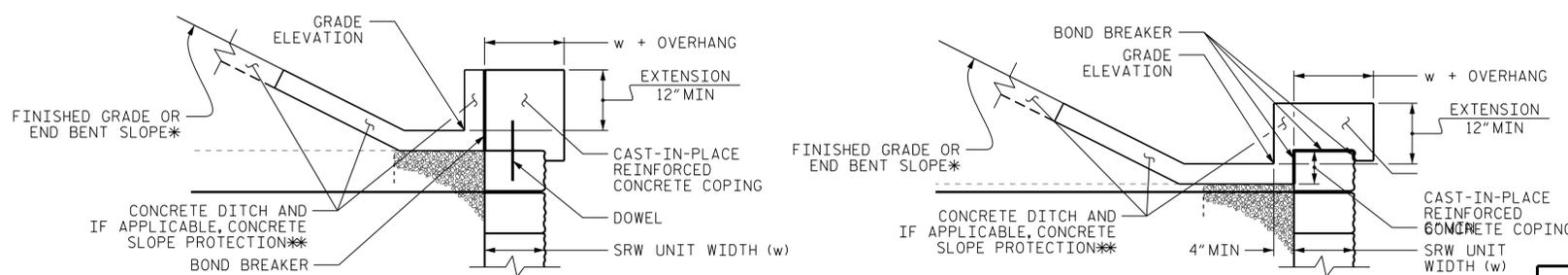
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**MSE WALL WITH SRW UNITS - TYPICAL SECTION**

\*SEE COPING DETAILS AND PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.  
\*\*SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE, MSE WALL NOTES FOR EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.



**COPING DETAILS**

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO SRW UNITS WITH DOWELS OR EXTEND COPING DOWN BACK OF SRW UNITS.  
\*SEE PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.  
\*\*SEE CONCRETE DITCH BEHIND WALL DETAILS.

PROJECT NO.: U-2412A  
GUILFORD COUNTY  
STATION: 18+50 -Y17-  
SHEET 3 OF 4

**NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
ENGINEERING UNIT**

REVISIONS						SHEET NO. W-3
NO.	BY	DATE	NO.	BY	DATE	
1			3			
2			4			

PREPARED BY: T. T. ZAN	DATE: 1/2018
REVIEWED BY: J. BATTS	DATE: 1/2018

GEOTECHNICAL ENGINEER    DocuSigned by: <i>T. T. Zan</i> <small>443688609615472</small> SIGNATURE	ENGINEER           DATE: 1/16/2018 SIGNATURE: _____ DATE: _____
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**NOTES:**

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.

FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.

AT THE CONTRACTOR'S OPTION, USE AN MSE WALL SYSTEM WITH SEGMENTAL RETAINING WALL UNITS (SRW) UNITS THAT MEET ARTICLE 1040-4 OF THE STANDARD SPECIFICATIONS FOR RETAINING WALL NO. 1.

AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF RETAINING WALL NO. 1.

A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR RETAINING WALL NO. 1.

A DRAIN IS REQUIRED FOR RETAINING WALL NO. 1.

BEFORE BEGINNING MSE WALL DESIGN FOR RETAINING WALL NO. 1, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

- DESIGN RETAINING WALL NO. FOR THE FOLLOWING:
- 1) H = DESIGN HEIGHT + EMBEDMENT
  - 2) DESIGN LIFE = 100 YEARS
  - 3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL = 3,650 PSF
  - 4) MINIMUM REINFORCEMENT LENGTH (L) = 1.0 H
  - 6) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT ( $\gamma$ ) PCF	FRICTION ANGLE ( $\phi$ ) DEGREES	COHESION (c) PSF
COARSE	110	38	0
FINE	115	34	0

\*SEE MSE RETAINING WALLS PROVISION FOR COARSE AND FINE AGGREGATE MATERIAL REQUIREMENTS.

7) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT ( $\gamma$ ) PCF	FRICTION ANGLE ( $\phi$ ) DEGREES	COHESION (c) PSF
BACKFILL	120	30	0
FOUNDATION	120	35	0

DESIGN RETAINING WALL NO. 1 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH REINFORCEMENT FOR RETAINING WALL NO. 1.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR RETAINING WALL NO. 1 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.

"TEMPORARY SHORING" MAY BE REQUIRED FOR RETAINING WALL NO. 1 IN ACCORDANCE WITH THE TEMPORARY SHORING PROVISION. SEE TRAFFIC CONTROL PLANS.

PROJECT NO.: U-2412A  
GUILFORD COUNTY  
 STATION: 18+50 -Y17-  
 SHEET 4 OF 4

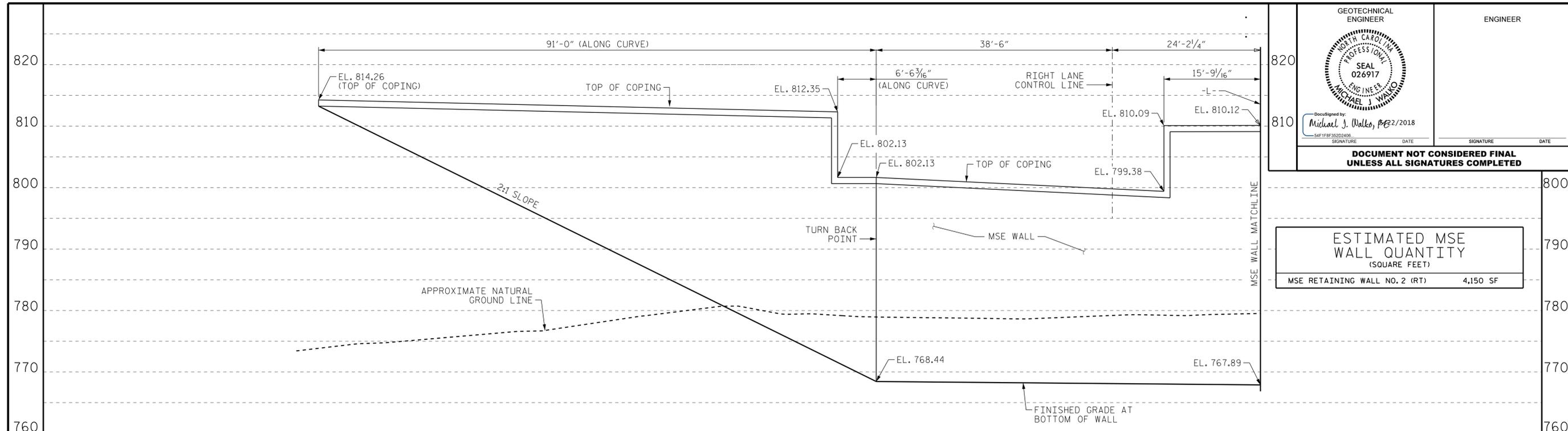


**NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
ENGINEERING UNIT**

MSE RETAINING WALL NO. 1 NOTES					
REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1	-	-	3	-	-
2	-	-	4	-	-
					SHEET NO. W-4

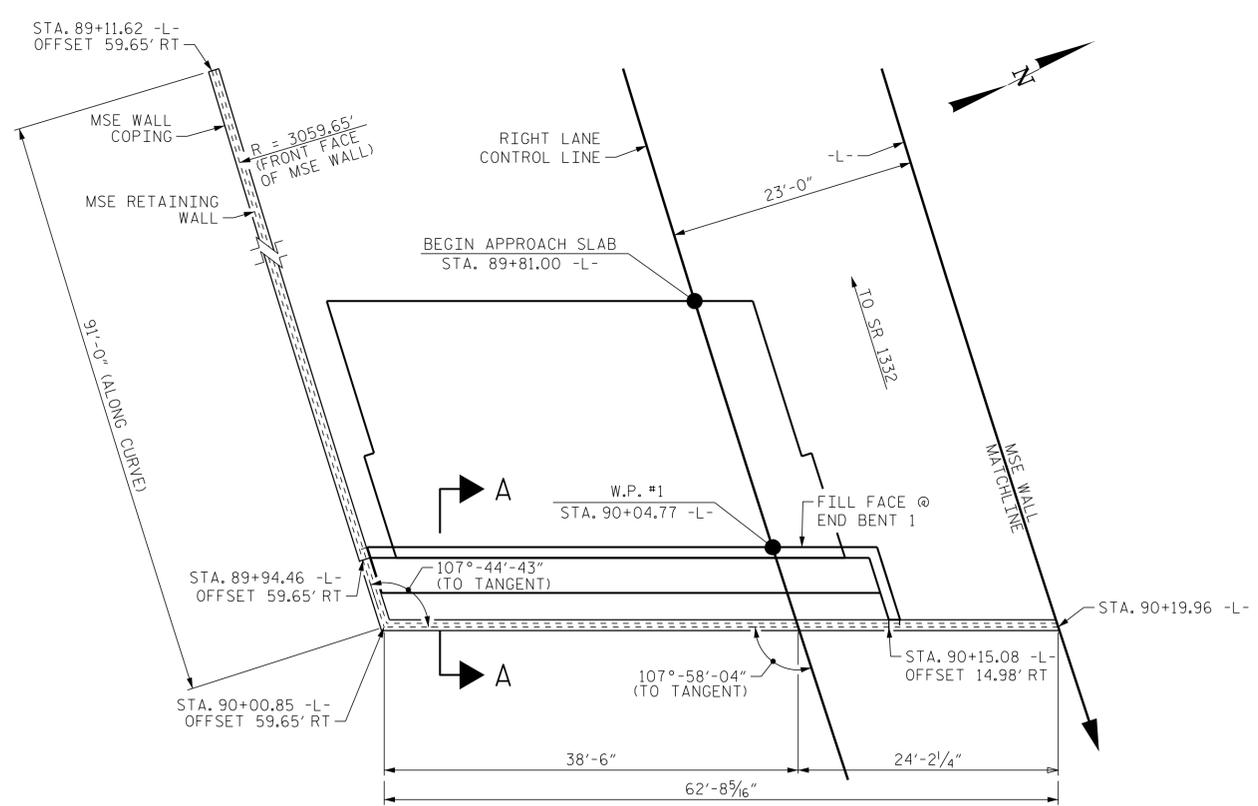
PREPARED BY: T. T. ZAN	DATE: 1/2018
REVIEWED BY: J. BATTS	DATE: 1/2018



GEOTECHNICAL ENGINEER  
 ENGINEER  
 SEAL 026917  
 Michael J. Walko, P.E. 2/2018  
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ESTIMATED MSE WALL QUANTITY (SQUARE FEET)	
MSE RETAINING WALL NO. 2 (RT)	4,150 SF

LOOKING BACKSTATION (-L-) AT FRONT FACE OF MSE WALL AT END BENT 1



PLAN

PROJECT NO.: U-2412A  
 GUILFORD COUNTY  
 STATION: -L- 93+23.34  
 SHEET 1 OF 5

PREPARED BY: T. CRUMP	DATE: 5/21/18
REVIEWED BY: M. WALKO, P.E.	DATE: 5/21/18

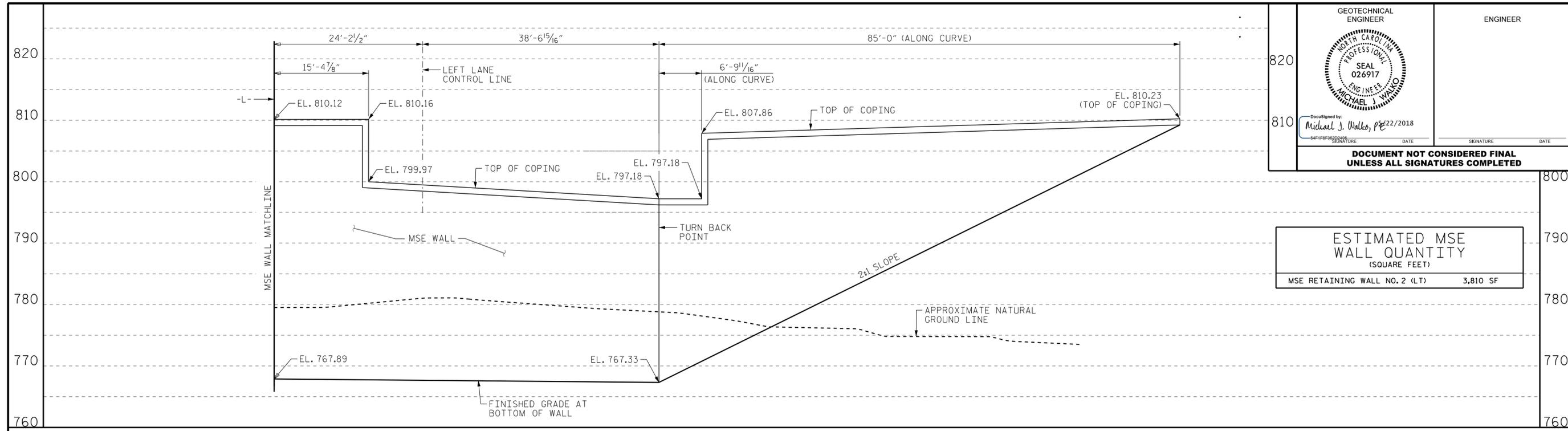
Prepared in the Office of:  
**ECS**  
 ECS SOUTHEAST, LLP  
 1812 CENTER PARK DRIVE, SUITE D  
 CHARLOTTE, NC 28217  
 (704) 525-5152 [PHONE]  
 (704) 357-0023 [FAX]  
 NC REGISTERED ENGINEERING FIRM # F-1078

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS  
**GEOTECHNICAL ENGINEERING UNIT**

MSE RETAINING WALL NO. 2  
END BENT 1 (RT)  
WALL ENVELOPE & PLAN VIEW

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-5



GEOTECHNICAL ENGINEER  
ENGINEER

SEAL 026917  
MICHAEL J. WALKO

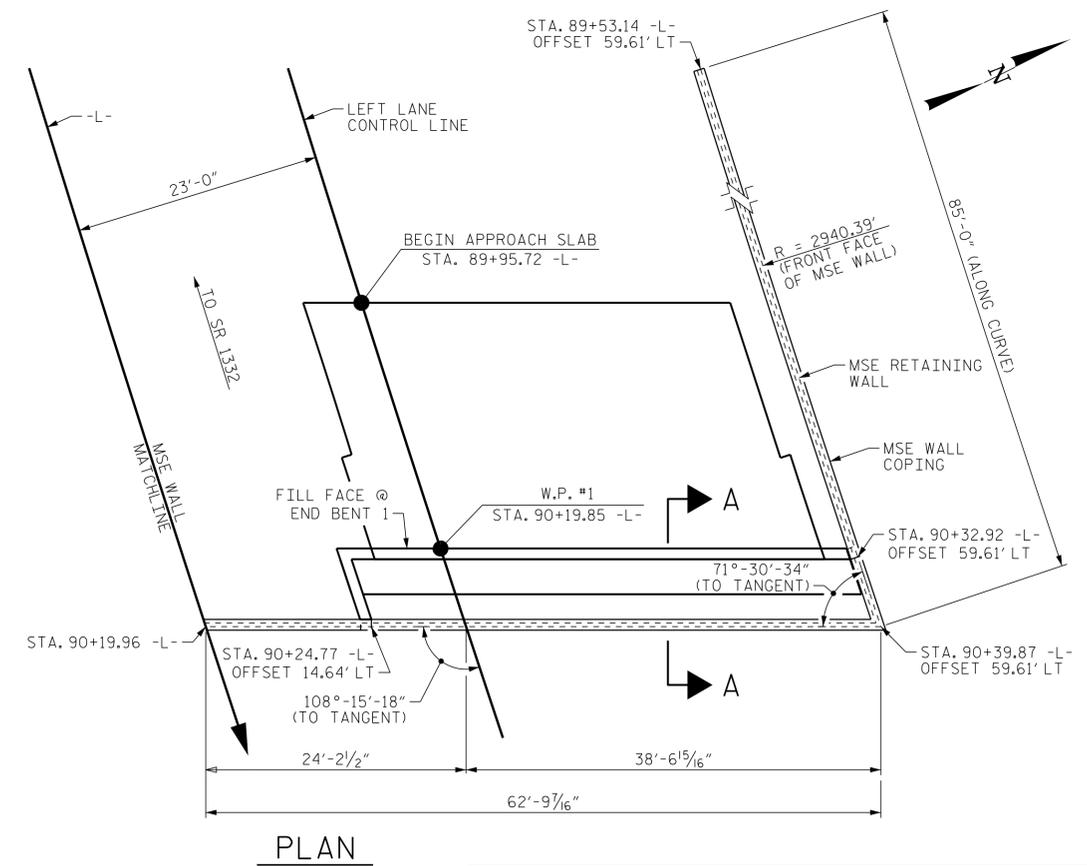
DocuSigned by:  
Michael J. Walko, PE 5/22/2018

DATE DATE DATE DATE

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ESTIMATED MSE WALL QUANTITY (SQUARE FEET)	
MSE RETAINING WALL NO. 2 (LT)	3,810 SF

LOOKING BACKSTATION (-L-) AT FRONT FACE OF MSE WALL AT END BENT 1



PROJECT NO.: U-2412A  
GUILFORD COUNTY  
STATION: -L- 93+43.36  
SHEET 2 OF 5

PREPARED BY: T. CRUMP  
REVIEWED BY: M. WALKO, P.E.

DATE: 5/21/18  
DATE: 5/21/18

Prepared in the Office of:

**ECS**

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NC REGISTERED ENGINEERING FIRM # F-1078

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

**GEOTECHNICAL ENGINEERING UNIT**

MSE RETAINING WALL NO. 2  
END BENT 1 (LT)  
WALL ENVELOPE & PLAN VIEW

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
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SHEET NO. W-6

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**NOTES:**

FOR MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS, SEE MECHANICALLY STABILIZED EARTH RETAINING WALLS PROVISION.  
 FOR TYPE III REINFORCED BRIDGE APPROACH FILL, SEE BRIDGE APPROACH FILLS PROVISION AND ROADWAY DETAIL DRAWING NO. 422D10.  
 FOR STEEL BEAM GUARDRAIL, SEE ROADWAY PLANS AND SECTION 862 OF THE STANDARD SPECIFICATIONS.

AT THE CONTRACTOR'S OPTION, USE FINE AGGREGATE IN THE REINFORCED ZONE OF MSE RETAINING WALL NO. 1.  
 A SEPARATION GEOTEXTILE IS REQUIRED AT THE BACK OF THE REINFORCED ZONE FOR MSE RETAINING WALL NO. 1.  
 A DRAIN IS REQUIRED FOR MSE RETAINING WALL NO. 1.  
 BEFORE BEGINNING MSE WALL DESIGN FOR MSE RETAINING WALL NO. 1, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.

DESIGN MSE RETAINING WALL NO. 1 FOR THE FOLLOWING:  
 1) H = DESIGN HEIGHT + EMBEDMENT  
 2) DESIGN LIFE = 100 YEARS  
 3) MAXIMUM FACTORED VERTICAL PRESSURE ON FOUNDATION MATERIAL = 9,500 PSF  
 4) MINIMUM REINFORCEMENT LENGTH (L) = 0.7H OR 6 FT, WHICHEVER IS LONGER  
 5) MINIMUM EMBEDMENT FOR ABUMENT FRONT FACE = 2 FT BELOW PROPOSED GRADE  
 6) MINIMUM EMBEDMENT DEPTH FOR SIDE WALLS SHALL BE AS SHOWN BELOW. EMBEDMENT DEPTH SHALL BE MEASURED BELOW A THEORETICAL 4 FT WIDE HORIZONTAL BENCH, SEE STRUCTURE PLANS.

SLOPE IN FRONT OF WALL	MIN. EMBEDMENT DEPTH
3H:1V OR FLATTER	2 FT
2H:1V	2 FT

7) REINFORCED ZONE AGGREGATE PARAMETERS:

AGGREGATE TYPE*	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (φ) DEGREES	COHESION (c) PSF
COARSE	110	38	0
FINE	115	34	0

\*SEE MSE RETAINING WALLS PROVISION FOR COARSE AND FINE AGGREGATE MATERIAL REQUIREMENTS.

8) IN-SITU ASSUMED MATERIAL PARAMETERS:

MATERIAL TYPE	UNIT WEIGHT (γ) PCF	FRICTION ANGLE (φ) DEGREES	COHESION (c) PSF
BACKFILL	120	30	0
FOUNDATION	120	30	0

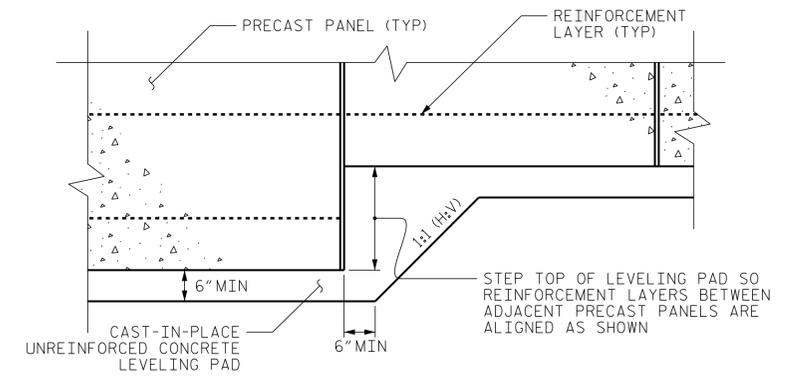
WITHIN 55 FT OF CENTERLINE, DESIGN MSE RETAINING WALL NO. 1 FOR A LIVE LOAD (TRAFFIC) SURCHARGE.

DESIGN REINFORCEMENT CONNECTED TO END BENT CAPS FOR FACTORED LOAD AND LENGTH OF REINFORCEMENT IN ACTIVE ZONE (L) SHOWN. CAST REINFORCEMENT OR CONNECTORS INTO CAP BACKWALL FOR END BENT NO. 1 LOCATED AT STATION 90+04.77 (RT) AND 90+19.85 (LT). MAINTAIN A CLEARANCE OF AT LEAST 3" BETWEEN REINFORCEMENT OR CONNECTORS AND REINFORCING STEEL IN CAP.

EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES WILL INTERFERE WITH REINFORCEMENT FOR MSE RETAINING WALL NO. 1.

FOUNDATIONS FOR END BENT NO. 1 LOCATED AT STATION 90+04.77 (RT) AND 90+19.85 (LT) WILL INTERFERE WITH REINFORCEMENT FOR MSE RETAINING WALL NO. 1. SEE "FOUNDATION LAYOUT" SHEET FOR FOUNDATION LOCATIONS.

DO NOT PLACE LEVELING PAD CONCRETE, AGGREGATE OR REINFORCEMENT FOR MSE RETAINING WALL NO. 1 UNTIL EXCAVATION DIMENSIONS AND FOUNDATION MATERIAL ARE APPROVED.



PRECAST CONCRETE PANELS

LEVELING PAD STEP DETAILS

PROJECT NO.: U-2412A  
 GUILFORD COUNTY  
 STATION: -L- 93+23.34 & 93+43.36  
 SHEET 3 OF 5

PREPARED BY: T. CRUMP	DATE: 5/21/18
REVIEWED BY: M. WALKO, P.E.	DATE: 5/21/18

Prepared in the Office of:



**ECS SOUTHEAST, LLP**  
 1812 CENTER PARK DRIVE, SUITE D  
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 (704) 525-5152 [PHONE]  
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 NC REGISTERED ENGINEERING FIRM # F-1078



**NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
 ENGINEERING UNIT**

**MSE RETAINING WALL NO. 2  
 NOTES & DETAILS**

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W-7
2			4			

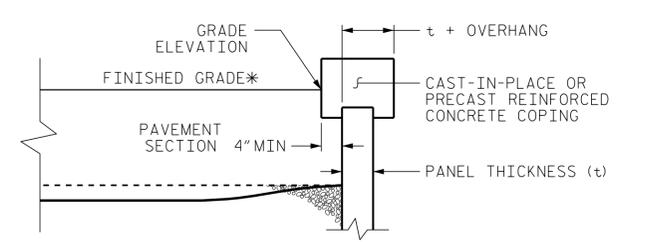
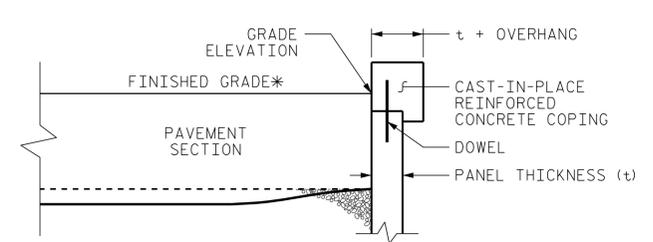
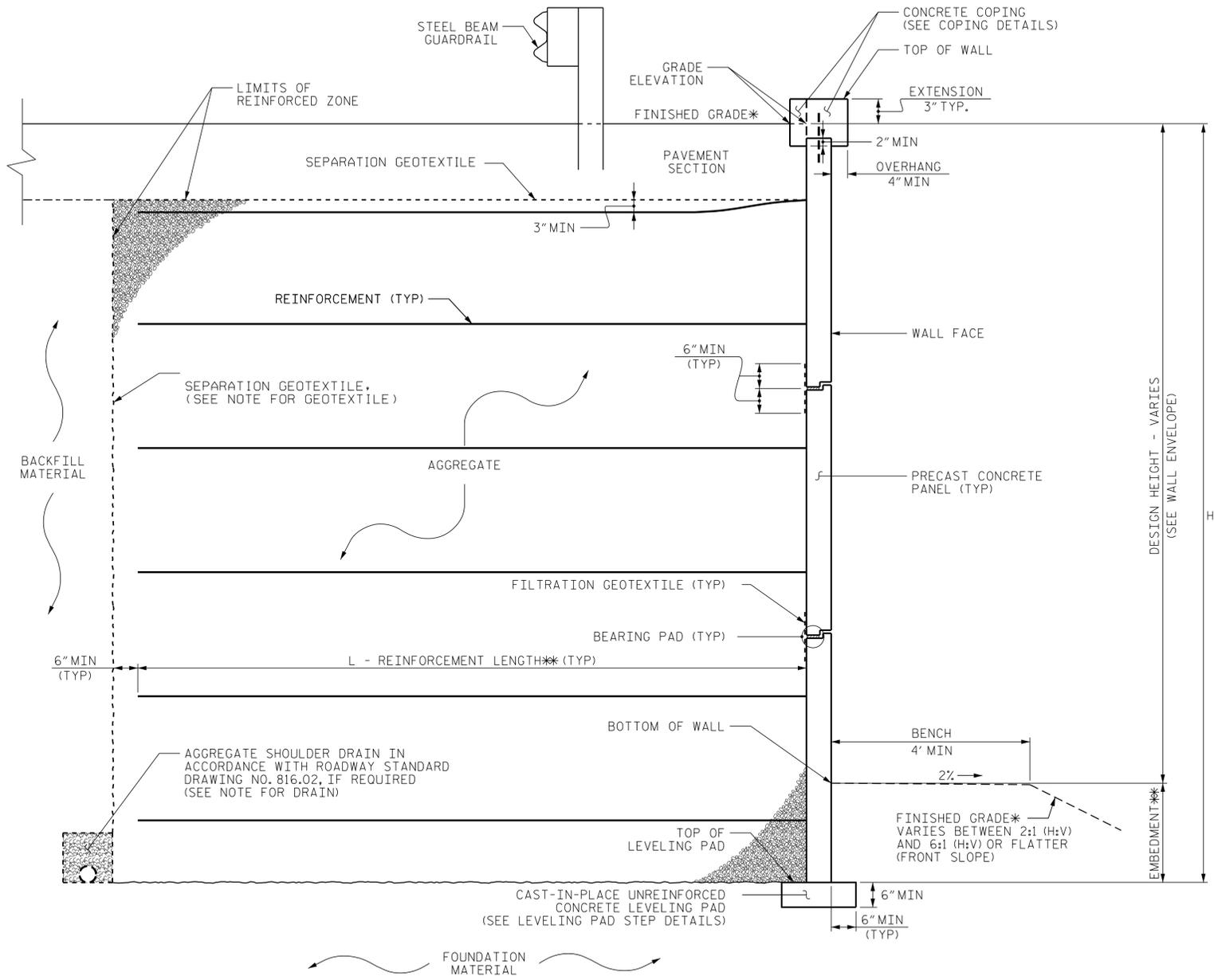
GEOTECHNICAL ENGINEER

ENGINEER

DocuSigned by:  
Michael J. Walko, PE 2/22/2018

SIGNATURE DATE SIGNATURE DATE

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**COPING DETAILS**

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.  
\*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.

**MSE WALL WITH PRECAST PANELS - SECTION THRU WALL**

\*SEE COPING DETAILS AND PLANS FOR FINISHED GRADE OR END BENT SLOPE DETAILS.  
\*\*SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE, MSE WALL NOTES FOR EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.

PROJECT NO.: U-2412A  
GUILFORD COUNTY  
STATION: -L- 93+23.34 & 93+43.36  
SHEET 4 OF 5

PREPARED BY: T. CRUMP	DATE: 5/21/18
REVIEWED BY: M. WALKO, P.E.	DATE: 5/21/18

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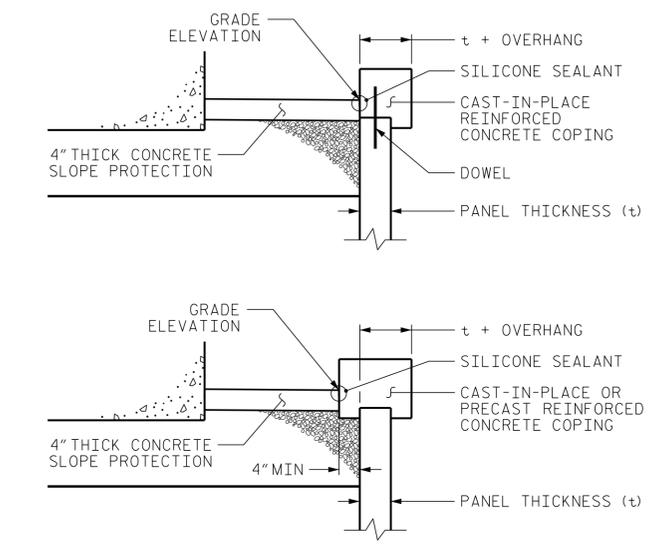
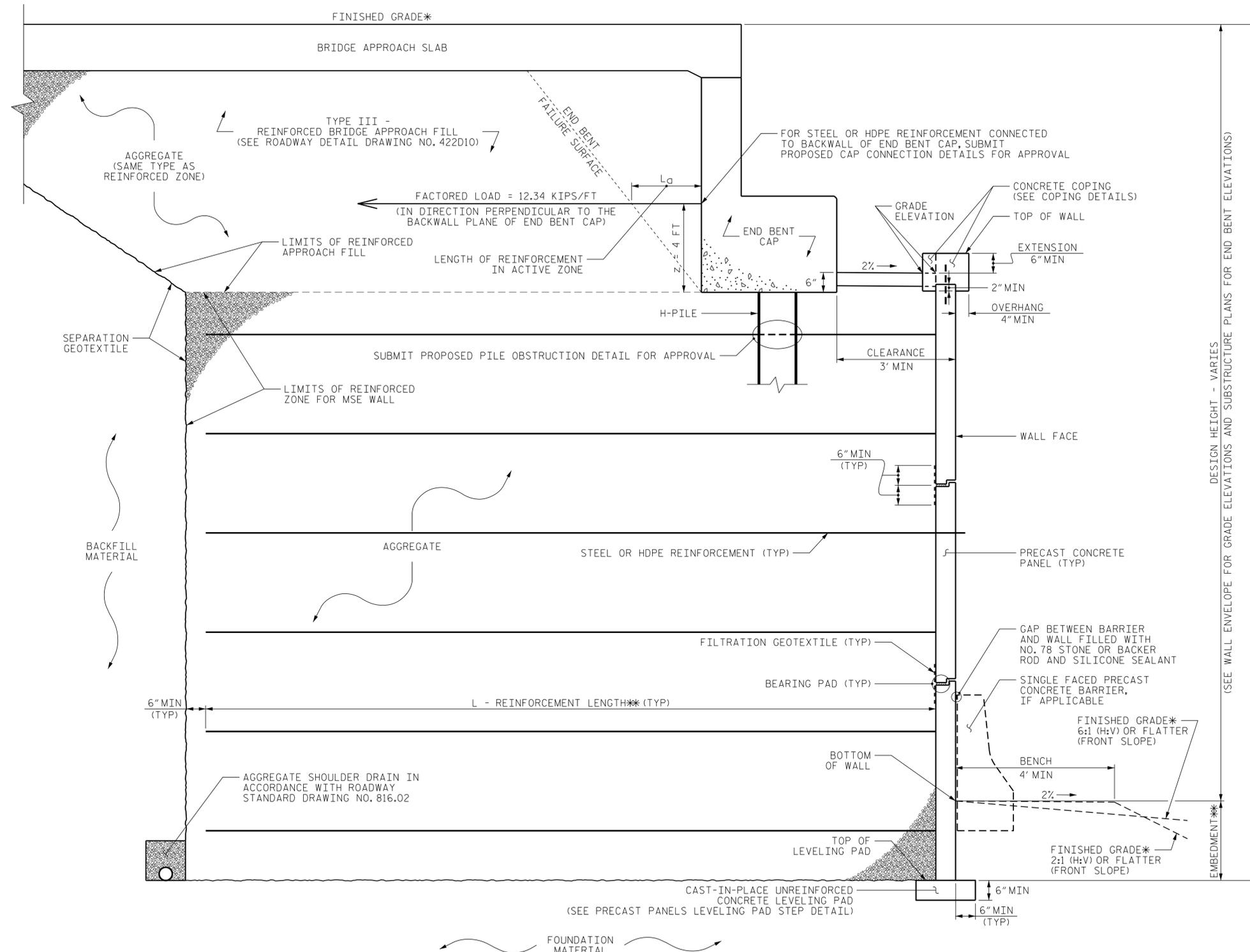
**NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
ENGINEERING UNIT**

**MSE RETAINING WALL NO. 2  
MSE WALL WITH PANELS  
TYPICAL & COPING DETAILS**

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-8



**COPING DETAILS**

AT THE CONTRACTOR'S OPTION, CONNECT COPING TO PANELS WITH DOWELS OR EXTEND COPING DOWN BACK OF PANELS.

**MSE ABUTMENT WALL WITH PRECAST PANELS - TYPICAL SECTION**

\*SEE ROADWAY PLANS FOR FINISHED GRADE DETAILS.  
 \*\*SEE MSE RETAINING WALLS PROVISION AND IF APPLICABLE, MSE WALL NOTES FOR EMBEDMENT AND REINFORCEMENT LENGTH REQUIREMENTS.

PROJECT NO.: U-2412A  
 GUILFORD COUNTY  
 STATION: -L- 93+23.34 & 93+43.36  
 SHEET 5 OF 5

PREPARED BY: T. CRUMP	DATE: 5/21/18
REVIEWED BY: M. WALKO, P.E.	DATE: 5/21/18

Prepared in the Office of:



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 (704) 525-5152 [PHONE]  
 (704) 357-0023 [FAX]  
 NC REGISTERED  
 ENGINEERING  
 FIRM # F-1078



**NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
 ENGINEERING UNIT**

**MSE RETAINING WALL NO. 2  
 WALL WITH PANELS, END BENT  
 ON H-PILES TYPICAL  
 & COPING DETAILS**

REVISIONS					
NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

SHEET NO. W-9